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The southern hemisphere Long Baseline Array

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VLBI observations have been made in Australia since the 1960s, but it was not until the formation of the Australia Telescope National Facility in 1990 that routine, open VLBI observing became possible [1]. A VLBI capability was deeply embedded in the concept of CSIRO's Australia Telescope National Facility (ATNF) from its beginning, with the expectation that the three CSIRO telescopes – Parkes, the ATCA and Mopra – would be used with other telescopes for VLBI observations.

The southern hemisphere Long Baseline Array (LBA) is coordinated by CSIRO, and routinely uses the three CSIRO telescopes, the Hobart 26m and Ceduna 30m telescopes of the University of Tasmania, elements of the geodetic AuScope array [2], the 12m or 30m antennas of the Warkworth Observatory in New Zealand, and the Hartebeesthoek 26m in South Africa [3]. Antennas of the Canberra Deep Space Communication Complex (CDSCC) at Tidbinbilla occasionally join for portions of LBA observations as their spacecraft tracking commitments allow. The LBA observes regularly in bands between 1 GHz and 22 GHz. The ATCA and Mopra and a CDSCC 34m antenna have made observations at 32 GHz, and the ATCA and Mopra have recently participated in Global Mm VLBI Array (GMVA) observations at 86 GHz. The LBA usually observes in 4~5 blocks of ~5 days duration, spread across the year, with out-of-session observations also made as Target of Opportunity observations, or in coordination with other VLBI arrays. LBA data are recorded to disk, and e-transferred to the Pawsey Supercomputing Research Centre for correlation.

Recent changes to LBA capabilities include the installation of the Ultra-Wide Bandwidth "Low" receiver on the Parkes 64m telescope, *Murriyang*, which covers 700 MHz to 4 GHz [4]. Plans, currently unfunded, for a companion Ultra-Wide Bandwidth "High" receiver, covering 4~25 GHz would provide Parkes much greater frequency agility than has been possible to date. These receivers use a VLBI-compatible GPU-based backend which is able to support high data rates. A new cryogenically cooled Phased Array Feed receiver for Parkes, covering 800 MHz to 1.8 GHz, will provide an instantaneous wide field of view in this band with several VLBI beams able to be recorded simultaneously. The Australia Telescope Compact Array will replace its existing CABB correlator with a new GPU-based correlator, BIGCAT, which will enable the ATCA to record at higher VLBI bit rates than 1 Gbps for the first time. It is hoped that "phased-array" mode may be able to added to CSIRO's newest telescope, ASKAP, an array of thirty-six 12m dishes that operates in the 700 to 1800 MHz range.

As the SKA-Low telescope, covering 50—350 MHz, will be built in Western Australia this decade, consideration is being given to a VLBI capability in this band. SKA-Low will provide unmatched raw sensitivity at metre wavelengths, but without immediate prospects for delivering sub-arcsecond angular resolution. LAMBDA (the Low-frequency Australian Megametre Baseline Demonstrator Array), is a concept for a < 350-MHz array that seeks to build upon the existing LBA network and ATNF expertise in digital systems to establish an initial long baseline array operating in the SKA-Low band before SKA operations begin.

References

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